Installation manual from P&G

8.1 Installation manual from P&G (Penny & Giles)

8.1.1.1 Pilot + Operation

Study Chapter 1: Operation. It is important that the information in Chapter 1 is supplied with the wheelchair, either as part of the wheelchair user handbook or as a separate document.

This chapter sets out the installation conditions that must be complied with in order to meet the safety requirements of TÜV Product Service (Germany), ISO7176-14 and prEN12184.

If a wheelchair manufacturer's label is placed over the Pilot+ identification label, then to maintain the control system's TÜV approval Penny & Giles must be informed. Penny & Giles will then inform TÜV Product Service.

8.1.1.2 Program Settings

All programmable values are stored within the Power Module, therefore, if you change a Joystick Module or ALM there is no need to re-program the system. You must supply the Power Module programmed with the manufacturer's preset settings. Power Modules are always supplied by Penny & Giles with the preset settings shown on the relevant data sheet.

The preset settings are chosen with the wheelchair manufacturer to ensure safe operation and compliance with relevant legal requirements over the whole of the operating range of the joystick and speed control.

The wheelchair must stop within the maximum distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in prEN12184.

Users with particular disabilities may need very low braking rates. However, if the control system is programmed with a low braking rate, the stopping distance may be more than that specified. If this happens, the maximum speed must be re-programmed so that the stopping distance requirement is satisfied.

State in the wheelchair user handbook that it is the responsibility of the person programming the control system to make sure that the stopping distance requirement is satisfied. If the braking rate is low, the forward and reverse maximum speed settings may need to be re-programmed.

To assist the person in this task, include a graph in the wheelchair user handbook showing the relationship between the maximum forward/reverse speed settings and the forward/ reverse braking rate which is required to ensure the correct stopping distance.

It may be possible to program settings which compromise the stability of the wheelchair. Perform suitable tests to establish which programming restrictions are needed to prevent instability. State any programming restrictions in the wheelchair user handbook.

State in the wheelchair user handbook that it is the responsibility of the person programming the control system to make sure that the settings are safe and to note any programming changes that they make.

It is possible for wheelchair manufacturers to limit the values of speeds and accelerations that can be programmed in the field. This facility ensures a safe-operating envelope for the wheelchair can be maintained. These limits are set in the factory by Penny & Giles and can only be altered by Penny & Giles.

WARNING: Programming should only be conducted by healthcare professionals with in-depth knowledge of Penny & Giles electronic control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for the user. Penny & Giles accept no liability for losses of any kind if the programming of the control system is altered from factory preset values. Penny & Giles accept no liability for losses of any kind if the drive or stability characteristics of the wheelchair are altered without prior notification and discussion with Penny & Giles.

8.1.1.3 Soft-Stop

If the version of Pilot+ you have has the Soft-Stop function enabled (see data sheet), you must ensure that the emergency stopping distance is within the distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in prEN12184.

8..1.1.4 Other Information

You must provide a diagram in the wheelchair user handbook showing the user controls.

In addition, you should include a brief specification of operating supply voltage range and operating temperature range.

8.1.2.0 Immobilizing the Wheelchair

8.1.2.1 Prevention of Unauthorized Use

TÜV Product Service requires that the wheelchair must have a means of preventing unauthorized use. This function is provided in the Pilot+ Joystick Modules, see chapter 1 section 3.2.

8.1.2.2 Charger Interlock

ISO 7176-14 requires you to provide a means of preventing the use of the wheelchair while the batteries are being charged. The charger sockets fitted to the Pilot+ Joystick Modules include an inhibit facility, refer to section 5.1 for further details.

Contact Penny & Giles if you need advice.

8.1.2.3 Sleep Mode

The control system can be programmed to “go to sleep” if the joystick is not operated for a period of time, see chapter 3 section 4.8. The sleep state is indicated a by short blink of the TruCharge display once every 2.5 seconds.

To re-start, switch the control system off and on again.

8.1.3.0 Power Module Wiring

8.1.3.1 General

Study the data sheet for the Power Module to identify the output current, ratings and restrictions

Recommendations for the cross-sectional area, ratings and materials for wiring are given in the table in section 3.2. These depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the wheelchair. Penny & Giles can make general recommendations for wiring to Pilot+ control systems, but Penny & Giles accepts no responsibility for the wiring arrangement used.

Make sure that the connectors you use are reliable under all operating conditions and correctly wired with no short circuits. Do not use unsuitable components - it may result in poor wheelchair reliability.

The power connectors for the Pilot+ Power Module are specially designed by Penny & Giles for wheelchair applications. The crimps are standard AMP Timer parts but the plastic housings are custom. Kits of connectors including the crimps, housings and rubber boots can be purchased from Penny & Giles or directly from the manufacturers, Intech. Intech will also provide a pre-assembled cable service. Intech's details are as below.

Intech
Tel: +44 (0)1522 575535
Fax: +44 (0)1522 523744

The connector part numbers are:

Connector	P&G Reference	Intech Part No.
Battery	D49712 PG-80B	IPG-5202
Motor/Brake	D49713 PG-80M	IPG-5401

Hand tools for crimping and extraction are available from Intech, the references are as below.

Crimp tool for 0.5-1.0mm^2 wire: ICT-249
Crimp tool for 2.5-4.0mm^2 wire: ICT-531
Crimp tool for 4.0-6.0mm^2 wire: ICT-532

Extraction tool for 0.5-1.0mm^2: IET-503
Extraction tool for 2.5-6.0mm^2: IET-552

For details of automatic crimp tools contact Intech.

The diagram on page 2:18 gives details of the Power Module connections.

8.1.3.2 Wire Gauge and Types

The table below gives the minimum recommended wire sizes for various Pilot+ Power Module specifications.

These recommendations are derived from well proven field experience of various international wheelchair manufacturers. Nevertheless, it is advised that manufacturers confirm them by carrying out suitable tests. Keep wire lengths as short as possible.

Pilot + Power Module	Battery Wires	Motor Wires	Brake Wires
50A	4,0mm²	2,5mm²	0,5mm²
80A	6,0mm²	4,0mm²	0,5mm²

Note: Battery and motor wires should have 105ºC rated PVC insulation.

8.1.3.3 Battery Connections

The control system incorporates sophisticated current limiting circuitry as protection for the circuits in the control system.

ISO 7176-14 requires you to provide protection against short circuits in the battery wiring and the power loom or the extremely unlikely event of a short circuit in the control system.

Place a suitable circuit breaker in series with the battery supply, for example in the link between two 12V batteries. If your batteries are held in separate enclosures, you must provide a circuit breaker with each of them.

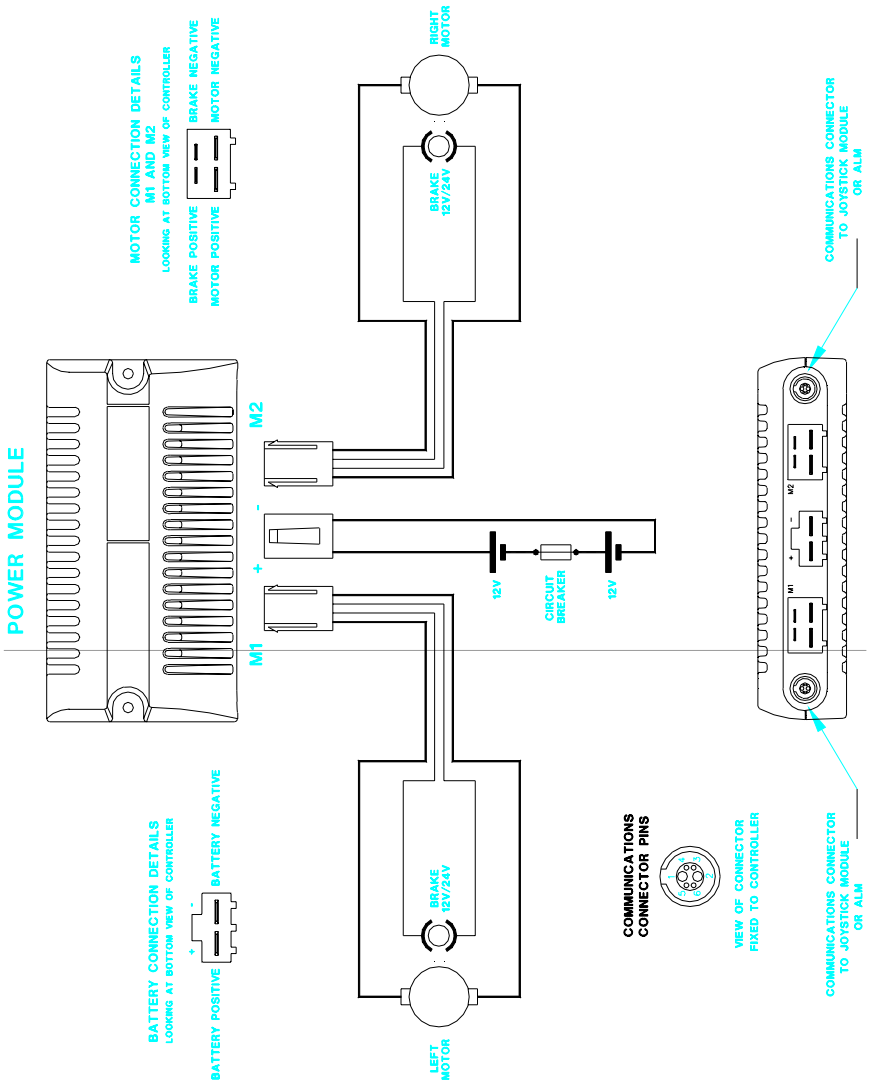
The rating of the circuit breaker must match the capacity of the wiring specified in section 3.2. For Pilot+ 50A Power Modules the circuit breaker rating should not exceed a 50A maximum rating. For Pilot+ 80A Power Modules the circuit breaker rating should not exceed 70A. These ratings refer to the MP16 series of circuit breakers manufactured by Mechanical Products Inc.

ISO 7176-14 states that the minimum operating time for the circuit breaker when the wheelchair is stalled is 15 seconds.

8.1.3.4 Motor Connections

If a circuit breaker is fitted in series with a motor, it is essential that the wheelchair assumes a safe condition the moment the circuit breaker operates. You must therefore fit a circuit breaker with an auxiliary switch which disconnects the solenoid brake from the Power Module.

Power Module Connection Diagram



8.1.3.5 Inhibit or Speed Limit Connections

If an inhibit or speed limit function is required on the wheelchair, a suitable switch(es) can be connected to the ALM's speed limit input or, if an ALM is not fitted, directly to the Power Module via the spare communications connector. These inputs have 4 levels - set by external resistance - which result in a different values of speed limit. The table below gives further details. The Mid, Slow and Inhibit speed limit values can be changed by factory programming, contact Penny & Giles for more details.

Resistance *	Inhibit Polarity Low **	Inhibit Polarity High **
Short circuit	Inhibit Speed	Normal Speed
22KΩ ± 10%	Slow Speed	Mid Speed
100KΩ ± 10%	Mid Speed	Slow Speed
Open circuit	Normal Speed	Inhibit Speed

* Value of resistance connected between ALM PL2 pins 11 and 12 (see ALM Connection Diagram), or Power Module communications connector pins 2 and 3 (see Power Module Connection Diagram).

** The polarity of the input is programmable, see chapter 3 section 5.11 for programming details. This feature allows maximum flexibility when configuring fail-safe systems.

The inhibit function is implementing by programming the Inhibit Speed limit to a level of zero. When this is done, the input can be set to be latching or non-latching, see chapter 3 section 5.11 for details.

To ensure the wheelchair is always able to turn on difficult surfaces, such as thick carpet, the speed limit for turning speed is never less than the programmed minimum Turning Speed (see chapter 3 section 4.7).

This input requires only a very small current so a wire size of 0.22mm^2 is suitable.

8.1.4.0 Joystick Module Wiring

The Joystick Module is connected to the Power Module with a 6 way cable assembly. Always ensure the cable is correctly mated at both ends by pushing the connectors' outer sleeves until they are fully in position.

Route and secure the cable in such a way as to prevent damage, for example by crushing or cutting.

8.1.5.0 Batteries

The control system is designed for operation with 24V lead acid batteries. The batteries may be wet or gel electrolyte types.

Contact Penny & Giles if you need advice on battery selection.

8.1.5.1 Battery Charging

The battery charging socket is mounted on the Joystick Module. The charging socket is Neutrik 3 pin type NC3FPP or equivalent, and the maximum charging current is 12A RMS. The pin connections of the socket are as below.

Pin	Connection
1	Battery +ve
2	Battery -ve
3	Charge Inhibit

To prevent the wheelchair from driving whilst the charger is connected, pin 3 must be linked to pin 2 inside the charger's plug.

8.1.6.0 Drive Motors

The control system is designed to be connected to permanent magnet DC motor, fitted with a suitable gearbox and solenoid brake.

In order to optimize the performance of the wheelchair, the control system must be matched to the motor terminal impedance, see chapter 3 section 5.5. The data sheet may define a motor compensation value (normally 70% of the total motor, cable and connector resistance).

Failure to match the control system with the motors may result in poor control characteristics, in particular speed stability on gradients may be affected.

If you have any doubts about the suitability of a particular motor type or you need advice on measuring motor impedance, contact Penny & Giles.

8.1.7.0 Solenoid Brakes

The solenoid brakes can be either 12V or 24V types, however, the control system must be programmed for the correct voltage. Refer to data sheet for the programming details of the control system. Refer to chapter 3 section 5.15 for information on programming.

If the current to either brake is less than 100mA or greater than 1A, a brake fault will be detected.

WARNING: It is essential that the control system is programmed for the correct brake voltage. If it is not, damage may occur to the brakes or the drive performance of the wheelchair may be affected.

8.1.8.0 Actuator and Lighting Module (ALM) Wiring

This section is applicable if the wheelchair is fitted with lights or actuators controlled from

the Joystick Module.

8.1.8.1 General

Study the data sheet for the ALM to identify:

i) the output current, ratings and restrictions
ii) the connector pin assignments

Refer also to the ALM connection diagram on page 2:22.

Recommendations for the cross-sectional area, ratings and materials for wiring will depend on the application. You are responsible for establishing the suitability of the particular wiring arrangement used on the wheelchair. Penny & Giles can make general recommendations for wiring for particular control system types, but Penny & Giles accepts no responsibility for the wiring arrangement used.

Make sure that the connection methods you use are reliable under all operating conditions and correctly wired with no short circuits. Do not use unsuitable components - it may result in poor wheelchair reliability.

8.1.8.2 Connection to the Power Module

The ALM is connected to the Pilot+ Power Module with a 6 way cable and connector. Always ensure the cable is correctly mated by pushing the connector's outer sleeve until it is fully in position.

8.1.8.3 Connection to the Lights, Actuators and Speed Limit Input

These connection are via spring connectors PL1 and PL2. To connect the wires into each terminal, release the spring pressure by inserting a 3mm screwdriver and levering downwards, then push the wire fully into position. Wire gauges of up to 2.5mm^2 can be accommodated in each terminal. It is recommended that wires are solder tinned.

The ALM connection diagram on page 2:22 shows the terminal identification for PL1 and PL2.

8.1.8.4 Lighting Wiring

The lighting output is rated at 42W maximum. Use suitably rated wire to each bulb. The output is self-protecting against wiring and bulb faults and will shut-off if the maximum power rating is exceeded. Likewise, if the output becomes too hot it will shut-off to prevent permanent damage to itself.

TÜV stipulate that, to comply with the StVZO German Road Traffic Regulations, each rear light must be separately fused. You should therefore split the wiring from the ALM output so that each rear light is supplied via a different fuse. It is recommended that an 800mA quick blow fuse is used for the left hand front and rear lights, and that an identical fuse is used for the right hand front and rear lights.

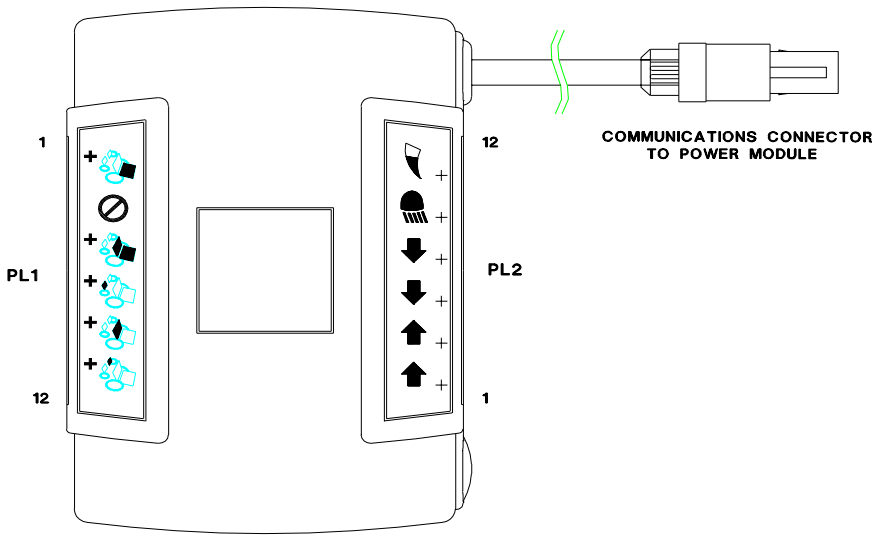
8.1.8.5 Indicator Wiring

The left and right indicator outputs are split, inside the ALM, into front and rear; this is to enable detection of an individual bulb failure. All currents referred to hereon in this section are the total of front and rear.

Each indicator output is rated at 42W maximum. Use suitably rated wire to each bulb. The outputs are self-protecting against wiring and bulb faults and will shut-off if the maximum

power rating is exceeded. Likewise, if either output becomes too hot it will shut-off to prevent permanent damage to itself.

ALM Connection Diagram



PL1 [1] [2]

Pin 1 Actuator Channel 1 +Backrest
Pin 2 Actuator Channel 1 - Backrest
Pin 3 Actuator Channel 2 +Spare
Pin 4 Actuator Channel 2 - Spare
Pin 5 Actuator Channel 3 +Seat tilt
Pin 6 Actuator Channel 3 - Seat tilt
Pin 7 Actuator Channel 4 +Left footrest
Pin 8 Actuator Channel 4 - Left footrest
Pin 9 Actuator Channel 5 +Seat height
Pin 10 Actuator Channel 5 - Seat height
Pin 11 Actuator Channel 6 +Right footrest
Pin 12 Actuator Channel 6 - Right footrest

PL2

Pin 12 Speed Limit Input
Pin 11 Speed Limit Input
Pin 10 Lights -
Pin 9 Lights +
Pin 8 Left rear indicator -
Pin 7 Left rear indicator +
Pin 6 Left front indicator -
Pin 5 Left front indicator +
Pin 4 Right rear indicator -
Pin 3 Right rear indicator +
Pin 2 Right front indicator -
Pin 1 Right front indicator +

[1] Not all channels may be active, refer to data sheet for further details.

[2] The channel to function assignments reflect the Penny & Giles standard. If custom Joystick Modules are used then these assignments may change.

Note: If desired, it is possible to use just one indicator "+" connection per side. However, the "-" connections must be kept separate.

If an indicator bulb fails, the ALM will detect this and flash the remaining bulb for that side at 3Hz as well as sending information to the Joystick Module so that the relevant indicator LED flashes likewise.

It is possible to use 3-wire lighting/indicator clusters with the ALM, but the following conditions must be followed.

i) The negative connection to the cluster must be the indicator negative, not lighting negative.

ii) It is only possible to connect one 3-wire cluster per side, i.e. only the front or rear lights/indicators may be connected in 3-wire configuration.

iii) It is possible to connect to connect all lights/indicators in 3-wire configuration but 4 external diodes need to be fitted. Please contact Penny & Giles for further details.

8.1.8.6 Actuator Wiring

Each actuator channel is rated at 10A maximum; however, when both footrests are operated simultaneously the rating is 5A per footrest. If the maximum current is required the wire gauge should be at least 1mm^2. Each actuator output will shut-off if the current from it is greater than 10A.

If the wheelchair is fitted with solid mechanical end-stops at the end of the actuator travel, it is not necessary to fit limit switches as the ALM will detect when the actuator motor has stopped and will cut-off the power to it.

8.1.8.7 Speed Limit Input Wiring

Pins 11 and 12 of PL2 can be used as a speed limit or inhibit input, refer to section 3.5 for more details.

This input requires only a very small current so wire gauge of 0.22mm^2 is suitable.

8.1.9.0 Bulbs

The ALM is designed to operate with 12V bulbs. The ALM will supply a constant power to the bulbs so that the brightness is not affected by variations in battery voltage.

The lighting output can supply a total power of 42W. Each indicator output can supply 42W.

8.1.10.0 Actuator Motors

The ALM is designed to be connected directly to permanent magnet DC motors. Please note the ALM may not be compatible with actuators which have their own over-current detection electronics. Actuator assemblies with slipping clutches may also be unsuitable as the motors will never stall, therefore not allowing the ALM to detect the end-stop. Please contact Penny & Giles if you are unsure.

8.1.11.0 Power Module Mounting

8.1.11.1 General

Fix the Power Module to the wheelchair chassis using suitable M5 or equivalent hardware.

8.1.11.2 Orientation

The function of the Power Module is not sensitive to mounting orientation: however, to

minimize the effect of water and dust, fix the control system with the connectors as the underside. The Power Module has an IP54 dust and water resistance rating.

8.1.11.3 Position

The Power Module must be mounted in a position where it is not exposed to water or dust, or subject to excessive shock or vibration.

The Power Module has excellent thermal performance but, to improve this further, it may be secured against a metal part of the wheelchair chassis. To provide even better thermal performance, a non-silicone thermally conductive paste or pad may be applied between the Power Module and the wheelchair chassis.

Contact Penny & Giles if you need further advice.

8.1.11.4 Cables

The cables to the Power Module must be routed and secured in such a way as to prevent damage to them, for example by cutting or crushing.

8.1.12.0 Joystick Module Mounting

8.1.12.1 General

The Joystick Module should be fitted to a bracket made from 25x3mm or 1”x1/8” stock bar, and secured using a M4x12mm or 8-32UNCx1/2” screw. Be careful not to overtighten the screw. See data sheet for further information.

8.1.12.2 Orientation

The Joystick Module must be mounted with the joystick shaft pointing vertically upwards. If you want to use any other mounting attitudes then contact Penny & Giles.

8.1.13.0 ALM Mounting

8.1.13.1 General

The ALM should be fitted to the wheelchair chassis with 2 off M5x8mm fixing screws. Be careful not to overtighten these screws.

8.1.13.2 Orientation

The ALM is not sensitive to mounting orientation except where it is exposed to water or dust. In this situation, to maintain the IP54 rating, the ALM must be mounted so that the fixing screws are lowermost.

8.1.13.3 Position

Do not mount the ALM in a position which would expose it to excessive shock or vibration.

8.1.13.4 Cables

Route and secure all the cables to the ALM in such a way as to prevent damage to them, for example by crushing or cutting.

8.1.14.0 Production Tests

Perform the following tests, in order, on each wheelchair before dispatch.

8.1.14.1 Mounting

Make sure that all modules are securely mounted. Do not overtighten any fixing screws.

8.1.14.2 Cables and Connectors

Check all cables for damage. Make sure that all connectors are securely mated.

8.1.14.3 Joystick and Gaiter

Check that the joystick is not bent or damaged.

Check the thin rubber gaiter or boot, around the base of the joystick shaft, for damage or splitting. Check visually only, do not handle the gaiter.

Check that the joystick returns to the center position when you push and release it.

8.1.14.4 Programmed Settings

Make sure that the control system has the correct settings. Refer to chapter 3 or the Programmer User Guide for detailed instructions.

Control systems are always supplied with the settings shown on the relevant data sheet.

8.1.14.5 Operational Test (Drive)

This test should be carried out on a level floor with at least one metre clear space around the wheelchair.

i) Switch on the control system.

ii) Check that the battery gauge remains on, or flashes slowly, after one second.

iii) Push the joystick slowly forwards until you hear the solenoid brakes operate. The chair may start to move.

iv) Immediately release the joystick. You must be able to hear each solenoid brake operate within a few seconds.

v) Repeat the test a further three times, pushing the joystick slowly backwards, left and right.

8.1.14.6 Test Drive

Drive the wheelchair and make sure that it operates correctly for all settings of the user controls.

8.1.14.7 Soft-Stop Test

If the control system has the Soft-Stop function enabled (see data sheet) then it must be tested prior to the wheelchair being dispatched. To do this, drive the wheelchair at full forward speed and switch the control system off. The wheelchair must not stop suddenly, but should decelerate to standstill. In addition, ensure that the requirements in section 1.3 of this chapter are satisfied.

WARNING: This test should be conducted in an open space and a restraining device such as a seat belt should always be used.

8.1.14.8 Lights, Indicators and Hazard Lamps Test

If lights are fitted, visually check each bulb for correct illumination.

If indicators are fitted, check each bulb for correct illumination and that the flashrate is 1.5Hz ± 0.5Hz. Disconnect each bulb in turn and check that the remaining bulb for that side flashes at 3Hz ± 0.5Hz.

If hazard lamps are fitted, check each bulb for correct illumination and that the flashrate is 1.5Hz ± 0.5Hz.

8.1.14.9 Actuator Test

If actuators are fitted, check each motor for correct direction of movement. Ensure the mechanical end-stops are secure and that they stall the actuator motors, thus operating the ALM's automatic end-stop detection.

8.1.14.10 Speed Limit Input Test

If this input is connected, check for correct operation at all speed levels.

8.1.15.0 Electromagnetic Compatibility (E.M.C.)

The Pilot+ family has been tested for compliance with EC directive 89/336/EEC, and the E.M.C. requirements of prEN12184, the FDA and the FCC. The guidelines in this section will help you to make sure that your wheelchair installation will easily meet these requirements. You should consider E.M.C. and perform relevant tests as early as possible in the design phase.

8.1.15.1 Emissions

A typical wheelchair and Pilot+ installation have been type tested and have passed the

requirements of CISPR 22 and FCC CFR47 part 15.

Observe the following recommendations to minimize radio frequency emissions:

8.1.15.1.1 Motor Suppression

For the drive motors solder a suitable suppression capacitor between the brush holders, inside the motor cases. Keep the capacitor's lead length as short as possible. We recommend a value of 4n7F 250V AC ceramic. The maximum value you should use is 10nF. A typical type is Roderstein WY0472MCMCF0K.
The above should also be applied to actuator motors, if fitted. If it is not possible to fit these capacitors inside the actuator motors, then contact the motor manufacturers for further advice. Alternatively, placing the capacitor externally, but as close as possible to the motor, may have the same effect.

8.1.15.1.2 Cables

You do not need to use screened battery and motor looms, but:

i) Keep the length of all wiring to a minimum.

ii) Make sure the loop area of the wiring is minimized. Route the positive and negative wires to each motor together. Route the battery positive and negative wires together. Where possible, route the battery and motor looms together. If fitted, route the lighting, indicator and actuator wires together.

iii) Secure all looms to the wheelchairs chassis over as much of their length as is practical.

iv) Do not use the control system connectors as junction points for the battery connections. Separate junction points away from the Power Module should be provided for the other wheelchair electrical functions.

8.1.15.2 Immunity

The Pilot+ control system family has been stringently tested for susceptibility to electromagnetic radiation over the frequency range 26MHz to 1GHz. The installations passed the FDA requirements and the proposed requirements of prEN12184.

Follow the recommendations in section 15.1.2 to ensure maximum immunity to electromagnetic radiation.

8.1.15.3 Electro-Static Discharge (E.S.D.)

There are various international standards currently under development for this aspect of the system's performance. At present, most of the standards are specifying the system to be tested to requirements of IEC1000-4-2. Tests are carried out at 8kV air discharge (to non-conductive surfaces) and 6kV contact discharge (to conductive surfaces). The Pilot+ family has been tested to these levels.

If you need advice please contact Penny & Giles.

8.1.16.0 Battery Gauge

Refer to Chapter 1 sections 9.0 and 9.1 for how to read the battery gauge.

The battery gauge typically starts to flash slowly when the battery voltage falls below 23.3V whilst the wheelchair is driving on a level surface.
For optimum accuracy of the battery gauge, the control system should be programmed with the approximate nominal capacity of the wheelchair battery. However, accuracy is not greatly affected if the programmed type and capacity do not closely match the battery.

The most important factor affecting the accuracy of the battery gauge is the resistance of the cable and connections between the battery and the Power Module. The control system must be matched approximately to the cable resistance of your wheelchair to make the battery gauge accurate, see chapter 3 section 5.6.1.
As a guide, 2.5mm^2 wire has a resistance of about 8 milliohms per metre; 4.0mm^2 wire has about 5 milliohms per metre and 6.0mm^2 has about 3.3 milliohms per metre. Circuit breakers and connectors usually account for about 15 milliohms.

These values will be chosen at the time the control system is being specified by the wheelchair manufacturer. Like the preset rates, once the values for the battery are decided, they are programmed into control systems during manufacture and should never need changing.

If you need advice, contact Penny & Giles.

Programming manual from P&G

8.2 Programming manual from P&G

8.2.1.0 Programming For Wheelchair Control systems

The main advantage of using programmable control systems is that they can be easily tailored to the specific needs and capabilities of a particular wheelchair user while taking into account the safe performance characteristics of the wheelchair being used. This means that wheelchairs fitted with a Penny & Giles Pilot+ control system can be readily programmed to be safe under normal driving conditions and also feel secure and comfortable to the user.

The programmable control system achieves this great flexibility by referring to a set of internal parameters which govern factors such as the wheelchair's speed, acceleration and braking. These parameters can be changed over a wide span to suit different wheelchairs and users, using a simple, hand-held programmer. Minimum and maximum limits can be applied to these parameters, thereby ensuring the wheelchair can only be programmed within a certain operating envelope. These limits can only be altered with the agreement of the wheelchair manufacturer and Penny & Giles.

All programmable values are stored within the Power Module, therefore, if you change a Joystick Module or ALM there is no need to re-program the system.

8.2.1.1 Important Note

It is possible to set up a control system so that it is unsuitable for some users and possibly even some wheelchairs. Take care when programming a control system and if you need any advice in programming or selecting values, please do not hesitate to contact Penny & Giles.

WARNING: Programming should only be conducted by healthcare professionals with in-depth knowledge of Penny & Giles electronic control systems. Incorrect programming could result in an unsafe set-up of a wheelchair for a user. Penny & Giles accept no liability for losses of any kind if the programming of the control system is altered from factory pre-set values.

8.2.2.0 PP1 Programmer

The PP1 is the handheld programmer that Penny & Giles supply for their Pilot+ control systems. Primarily intended for the specialized design and test requirements of wheelchair manufacturers and engineers, the PP1 takes full advantage of the complete programmability of the Pilot+, offering functions not available with less sophisticated control system designs.

The PP1 is a menu-driven programmer which plugs directly into the Pilot+' battery charging socket, and is available in two configurations, suited to different applications.

8.2.2.1 Basic PP1 Programmer (PP1a)

The most basic programmer version - the PP1a - is intended for general purpose use. It can set all of the key control system speed, acceleration and braking characteristics, and allows different settings to be tried out while the programmer is still plugged into the control system. A context-sensitive help function is available to guide users through the menus and the PP1 can also display error messages from the Pilot+ control system, allowing any problems with the wheelchair electrical system to be identified and corrected quickly. In addition, the Pilot+ fault log and elapsed time indicator can be read with the PP1a.

8.2.2.2 Engineering PP1 Programmer (PP1b)

The engineering version - the PP1b - offers all of the PP1a features but also includes a suite of advanced functions for designers, such as matching the control system to the motor impedance, setting maximum drive current and enabling front or rear wheel drive algorithms. Clearly, the PP1b is a very powerful tool for prototype design work. However, users who program parameters incorrectly do run the risk of damaging control systems or motors, so it should only be used by experts in wheelchair electrical systems.

2.3 PP1 Specifications

Functions	Notes	PP1a	PP1b
Acceleration	Vary from 0 (or factory set min.) to 100 (or factory set max.)	Unit steps	Unit steps
Deceleration	Vary from 0 (or factory set min.) to 100 (or factory set max.)	Unit steps	Unit steps
Tun Acceleration	Vary from 0 (or factory set min.) to 100 (or factory set max.)	Unit steps	Unit steps
Turn Deceleration	Vary from 0 (or factory set min.) to 100 (or factory set max.)	Unit steps	Unit steps
Forward Speed	Vary from 0 (or factory set min.) to 100% (or factory set max.)	1% steps	1% steps
Reverse Speed	Vary from 0 (or factory set min.) to 100% (or factory set max.)	1% steps	1% steps
Turn Speed	Vary from 0 (or factory set min.) to 100% (or factory set max.)	1% steps	1% steps
Sleep Timer	Period of time before control system "goes to sleep". (1 to 10 mins.)	1 min. steps	1 min. steps
Joystick Throw	Joystick deflection for full speed. (25% to 100%)	1% steps	1% steps
Steer Correct	Veer compensation for mis-matched motors		-9 to +9
Read Timer	Displays hours wheelchair in use	Yes	Yes
Read Fault Log	Displays fault code history	Yes	Yes
Preset Control system	Set drive functions to factory preset values	Yes	Yes
Help Mode	On-line help text.	Yes	Yes
Diagnostics	Reads fault code from Solo.	Yes	Yes
Soft Reverse	Prevents wheels digging in when braking in reverse down a slope. Percentage of forward brake rate. (25% to 100%)		1% steps
Current Limit	Maximum and mimimun current outputs. (20A to 80A).		1A steps
Foldback Temp.	Reduce current at this temperature (25°C to 70°C), then decrease current linearly until shut down temperature is reached.		1°C steps
Timed Foldback	Reduce current (25% to 100%) after stall time (5s to 10mins) to protect motors.		1% steps & 5s steps
Compensation	Match motor impedence for precise control. (0 to 1Ω).		5mΩ steps
Battery Menu	Match TruCharge display to loom resistance. (0 to 255mΩ).		1mΩ steps
Park Brake Trip[1]	For chairs without brakes.		Yes/No
Front Drive	Select algorithm for front wheel drive.		Yes/No
Fast Brake Rate	Slam braking by pulling joystick in reverse. (0 to 100%).		1% steps
Soft Stop	Controlled braking if control system switched off whilst driving.		Yes/No
Inhibit	Polarity and latched operation of speed limit input		Low/High & Yes/No
Profiles	Set Power Module to operate with drive profiles. (1 to 5)		1,2,3,4 or 5
Swap Motors	Exchanges left and right motor outputs.		Yes/No
Brake Voltage	Solenoid brake voltage (12/24V)		12V or 24V
Min Accel'n %	Vary from 0% to 100%		1% steps
Min Decel'n %	Vary from 0% to 100%		1% steps
Min Turn Acc. %	Vary from 0% to 100%		1% steps
Min Turn Dec. %	Vary from 0% to 100%		1% steps
Clear Timer	Reset elapsed timer		Yes/No
Erase Fault Log	Erases fault code history.		Yes
Preset Engineering Values	Set engineering functions to factory preset values		Yes

[1] See section 8.2.2.4

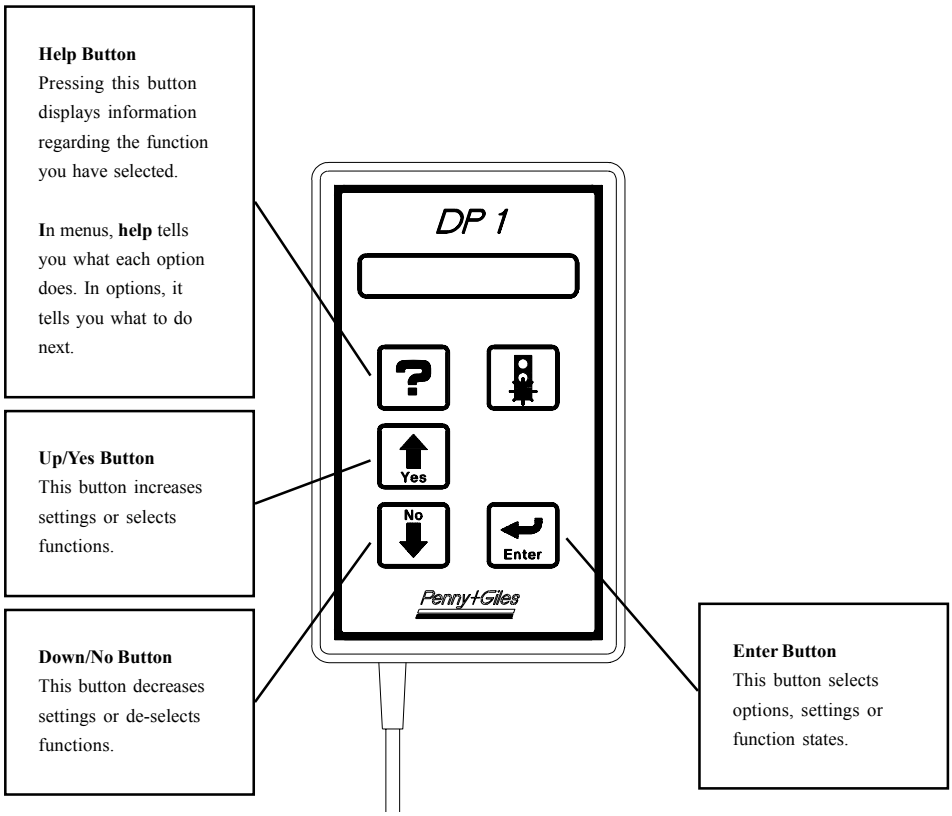
8.2..2.4 Important Note

Resetting parameters to non-compatible values could damage control systems and motors, and invalidate any warranties. Current Limit should never be set to a value greater than the values recommened for the Power Module you have, and Park Brake Trip should only be disabled on those chairs without solenoid brakes. Contact Penny & Giles if there is the slightest doubt. On a more general note, it is possible to set up a control system so that it is unsuitable for some users or even some wheelchairs. If you need any advice on programming, please do not hesitate to contact Penny & Giles.

3.0 Using The PP1

Please read this guide carefully before using the PP1 Programmer. Setting parameters to incorrect values could damage control systems and motors, and invalidate any warranties. In particular, Current Limit should never be set to a value greater than the recommended control system maximum.

3.1 PP1b Keypad Layout & Description


Help Button
Pressing this button displays information regarding the function you have selected.
In menus, help tells you what each option does. In options, it tells you what to do next.
Up/Yes Button
This button increases settings or selects functions.
Down/No Button
This button decreases settings or de-selects functions.
DP 1
Yes
No
Enter
Penny+Giles
Enter Button
This button selects options, settings or function states.

8.2.3.2 Connection

To program, you can connect the PP1 to the Pilot+, via the charging socket on the Joystick Module, if the system is either on or off. You can also drive with the PP1 connected.

Please note, for safety reasons, accessing some critical parameters will cause the control system to trip. This is indicated by the TruCharge display rippling up and down. This is intentional and the control system can be simply reset by switching off then on again.

To use the PP1 to view fault codes and messages, connect it to the control system when the control system has tripped. Note, if a trip occurs when the PP1 is already connected, then no diagnostic information will appear.

If you wish to program but the PP1 is showing diagnostic information, press the ***ENTER*** key and the PP1 will go into programming mode.

IMPORTANT: When the PP1 is connected to the Pilot+, the electromagnetic compatibility (E.M.C.) performance of the wheelchair may be affected. Disconnect the PP1 as soon as programming is complete and do not use the PP1 in environments which are E.M.C. sensitive.

8.2.4.0 Root Menu

The ROOT menu, which is included in both the PP1a and PP1b contains all the parameters which set the normal drive characteristics of the wheelchair. It is also possible to read the fault log and elapsed timer. Each parameter is explained in the following paragraphs.

8.2.4.1 Acceleration ?

Adjusts the value for forward and reverse acceleration of the wheelchair, from 0 to 100 in steps of 1. A higher value gives faster acceleration. This programmed value of acceleration occurs when the Joystick Module has speed setting 5 selected. Its value at other settings depends on the value of the ***Min Accel'n*** % parameter, see section 5.15.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value to be higher than this limit, contact Penny & Giles.

8.2.4.2 Deceleration ?

Adjusts the value for forward and reverse deceleration (or braking) of the wheelchair, from 0 to 100 in steps of 1. A higher value gives faster deceleration. This programmed value of deceleration occurs when the Joystick Module has speed setting 5 selected. Its value at other settings depends on the value of the Min Decel'n % parameter, see section 5.16.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value to be higher than this limit, contact Penny & Giles.
4.3 Turn Accel'n ?

8.2.4.3 Turn Accel'n ?

Adjusts the value for turning acceleration of the wheelchair, from 0 to 100 in steps of 1. A higher value gives faster acceleration. This programmed value of acceleration occurs when the Joystick Module has speed setting 5 selected. Its value at other settings depends on the value of the ***Min Turn Acc.*** % parameter, see section 5.17.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value to be higher than this limit, contact Penny & Giles.

8.2.4.4 Turn Decel'n ?

Adjusts the value for turning deceleration (or braking) of the wheelchair, from 0 to 100 in steps of 1. A higher value gives faster deceleration. This programmed value of deceleration occurs when the Joystick Module has speed setting 5 selected. Its value at other settings depends on the value of the Min Turn Dec.% parameter, see section 5.18.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value to be higher than this limit, contact Penny & Giles.

8.2.4.5 Forward Speed ?

Adjusts the minimum and maximum values for forward speed of the wheelchair, from 0 to 100% in steps of 1%. A higher value gives a faster speed. The minimum value occurs when the Joystick Module has speed setting 1 selected, and the maximum value occurs at speed setting 5.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.4.6 Reverse Speed ?

Adjusts the minimum and maximum values for reverse speed of the wheelchair, from 0 to 100% in steps of 1%. A higher value gives a faster speed. The minimum value occurs when the Joystick Module has speed setting 1 selected, and the maximum value occurs at speed setting 5.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.4.7 Turning Speed ?

Adjusts the minimum and maximum values for the turning speed of the wheelchair, from 0 to 100% in steps of 1%. A higher value gives a faster speed. The minimum value occurs when the Joystick Module has speed setting 1 selected, and the maximum value occurs at speed setting 5.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.4.8 Sleep Timer ?

Sets the period of time before the control system will “go to sleep” if the joystick is not operated. The time can be set between 1 and 10 minutes in steps of 1 minute. If the time is set to 0 the system will never “go to sleep”.

8.2.4.9 Joystick Throw ?

This allows you to program the control system so that full speed can be reached with a reduced joystcik movement (throw). This is particularyl useful for wheelchair users with limited hand or arm movement.

The adjustent can be made manually or by programming actual values.

8.2.4.9.1 Manual Adjustment

When the ***ENTER*** key is pressed the current setting for joystick throw in the forward direction will be displayed. If the joystick is displaced in the forward direction beyond 25%, then the actual joystick position will be displayed. Operation of the ***ENTER*** key will store the value displayed on the screen. This method can therefore be used to interactively set up the joystick throw with the wheelchair user.

The process is repeated for joystick reverse, left and right positions.

8.2.4.9.2 Programming Adjustment

When the ***ENTER*** key is pressed the current setting for joystick throw in the forward direction will be displayed. Operation of the ***UP*** or ***DOWN*** keys will change this setting, operation of the ***ENTER*** key will store the setting.

The process is repeated for joystick reverse, left and right positions.

8.2.4.10 Steer Correct ?

This factor compensates for any mismatching of motors to ensure that the wheelchair drives directly forward when the control system’s joystick is being pushed directly forward.

It is normally set to zero but may be varied from -9 to +9 in increments of 1. If the chair is veering to the left, you should increase the setting. If the chair veers to the right, decrease the setting.

8.2.4.11 Read Timer ?

The Pilot+ has a timer which records how long the wheelchair is in use. The timer runs whenever the joystick is moved away from the centre position, and stops when the joystick is returned. The timer records the number of hours the wheelchair has been in use.

To reset the timer see section 5.19

8.2.4.12 Read Fault Log ?

The Pilot+ has a fault log facility which stores the number of occurrences of the last eight faults.

This allows you to view the contents. The display format is as below.

1: Code 2C00, #1
2: Code 3C00, #3
no more entries

This reads line by line as.

Line 1 - fault code 2C00 has occurred once
Line 2 - fault code 3C00 has occurred three times
Only two fault types recorded.

To clear the fault log refer to section 5.21.

8.2.4.13 Preset Unit ?

Selecting this sets all ROOT menu parameters to their default values. These default values are decided between Penny & Giles and the wheelchair manufacturer.

8.2.5.0 Engineer Menu ?

Selection of this enters the engineering menu and allows you to adjust the technical performance parameters or functions of the control system. Each parameter or function is described below.

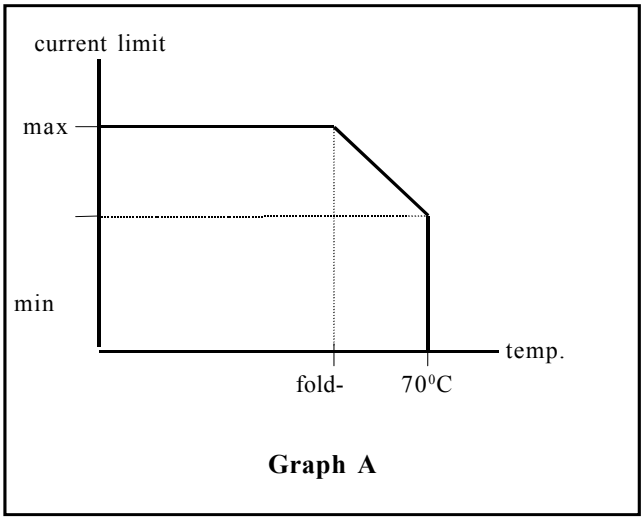
8.2.5.1 Soft Reverse ?

This sets the reverse braking rate. Reverse braking is normally 70% of forward braking to prevent the chair's tendency to topple when stopping in reverse on a gradient.

You can set the reverse braking between 25% and 100% of forward braking.

8.2.5.2 Current Limit ?

This sets the maximum and minimum current output for the control system. The current output is dependent on the internal temperature of the Power Module. Graph A (below) shows the relationship.



Graph A

Pilot+ Power Modules are ava ble below shows the recommended maximum to minimum relationships.

Max. Current Limit	Min. Current Limit
50A	40A
80A	60A

You can set the maximum and minimum current outputs between 20A and the maximum permitted upper value in steps of 1A.

8.2.5.3 Temp. Foldback ?

This is the internal Power Module temperature at which the current output starts to reduce, see Graph A. The table below shows the maximum value of temperature for each Power Module type.

Max. Current Limit	Temp. Foldback
50A	55ºC
80A	55ºC

IMPORTANT - the temperature value should never be set to more than the maximum possible for each control system type. Doing so will invalidate the warranty and affect the long term reliability of the control system.

8.2.5.4 Timed Foldback ?

This function allows a measure of protection for motors when they get into a stalled condition. You can set a 'Stall Time' of between 5 seconds and 10 minutes in 5 second increments after which time the maximum current limit is reduced to a percentage of the maximum current. This percentage (Foldback %) may be set between 25% and 100% of the current limit maximum in 1% steps.

After a fixed Reset Period of 5 x (Stall Time), the current limit will be allowed to return to the current limit maximum, if demanded. This reset period is to allow the motor(s) sufficient time to cool.

e.g. Power Module has current limit of 80A, stall time of 15 seconds and foldback % of 25%. This means that, if the motors are stalled, after 15 seconds the current output of the Power Module will reduce to 25% of 80A = 20A. After 5 x 15s = 75s, the current output will return to 80A.

8.2.5.5 Compensation *?*

This matches the control system to different motor types in order to achieve optimal performance and control. Penny & Giles recommend that you set this value to not more than 70% of the resistance of the motor armature and all cables and connectors to it.

IMPORTANT - never set to greater than 70%.

Motor manufacturers should be able to supply figures for armature resistance, and typical cable and connectors would be about 40mW.

8.2.5.6 Battery Menu ?

8.2.5.6.1 Battery Cable ?

This sets the value of cable and connector resistance between the control system and the batteries. The value corresponds to the total resistance in both the positive and negative paths.

You can set this between 0mW and 255mW in steps of 1mW.

8.2.5.6.2 Gauge Cal ?

This allows further fine calibration of the TruCharge battery gauge. This is normally set at the factory and should not need adjustment. Please contact Penny & Giles if you are considering altering this factor.

8.2.5.6.3 Back to E Menu ?

This returns you to the ENGINEER Menu

8.2.5.7 Park Brake Trip ?

This tells the control system whether or not to trip if one or both of the solenoid brakes become disconnected or are not fitted. You can turn this function on or off.

IMPORTANT - this function should only ever be turned off if there are no solenoid brakes fitted to the wheelchair.

8.2.5.8 Front Drive ?

This selects special front wheel drive control software. You can turn this on or off.

It is possible for wheelchair manufacturers, in conjunction with Penny & Giles, to change the driving characteristics of the front wheel drive software, please contact Penny & Giles for further details.

8.2.5.9 Fast Brake Rate ?

This sets the deceleration rate for fast braking. Fast braking is when the joystick is pulled to the reverse position to effect a faster stop. You can set the fast brake rate between 0 and 100. If this value is set lower than the normal Deceleration rate, then the latter rate will be used.

8.2.5.10 Soft Stop ?

This selects whether the soft-stop facility is enabled. Soft-stop means that if you switch the control system off whilst driving, the wheelchair will steadily decelerate to standstill.

You can turn this function on or off.

IMPORTANT - if this function is on, you must ensure that the emergency stopping distance is within the distance specified for the country in which the wheelchair will be used. TÜV Product Service (Germany) specify the distance to be as stated in prEN12184.

8.2.5.11 Set Inhibit ?

This sets the operation of the speed limit input. This input can also be used as an inhibit input if the Inhibit Speed limit value is set to zero, see chapter section 3.5 for more details.

There are two options associated with this function - polarity and latching.

active low - This is the polarity of the input. It can be set to yes or no. The table below shows the effect of the input on wheelchair speed for the two settings.

Speed Limit Input Resistance	Inhibit Polarity Low (active low = yes)	Inhibit Polarity High (active low = no)
Short circuit	Inhibit Speed	Normal Speed
22KΩ ±10%	Slow Speed	Mid Speed
100KΩ ± 10%	Mid Speed	Slow Speed
Open circuit	Normal Speed	Inhibit Speed

latched - This determines whether the control system trips when an inhibit signal (Inhibit Speed = 0) is received. It can be set to yes or no. Yes gives a trip condition and the system must be switched off and on again to reset. No means that drive can be resumed as soon as the inhibit signal is removed.

The settings for Inhibit, Slow and Mid Speed limits are factory programmable, if you want to alter these values please contact Penny & Giles.

8.2.5.12 Profiles ?

This function can only be used with customer specific Joystick Modul.es which support drive profiles. The Pilot+ generic Joystick Modules are not designed to operate with drive profiles, consequently, this valiue should be set to 0. For furhter information, please contact Penny & Giles.

8.2.5.13 Swap Motors?

This swaps the motor output connections, M1 and M2, on the Power Module. Normally M1 is for the left motor and M2 for the right motor.

You can select between yes and no. If set to yes, M1 will be for the right motor and M2 for the left motor. If set to no, the normal condition will apply.

Note, if you swap the motor connections the TruCharge motor diagnostic information will need to be interpreted differently, see chapter 1 section 8.5.

8.2.5.14 Brake Voltage ?

This sets the voltage output from the Power Module to the solenoid brakes. You can select either 12V or 24V.

WARNING: It is essential that the control system is programmed for the correct brake voltage. If it is not, damage may occur to the brakes or the drive performance of the wheelchair may be affected.

8.2.5.15 Min Accel'n % ?

Adjusts the minimum value for forward and reverse acceleration of the wheelchair.
It is programmed in increments of 1% of the ***Acceleration*** value. This percentage of the ***Acceleration*** value occurs when the Joystick Module's speed setting is at 1. For example: if ***Acceleration*** is set at 80 and ***Min Accel'n*** % is set at 25% then when the speed setting is 1, acceleration will be 25% x 80 = 20; and when the speed setting is 5, the acceleration will be 80. Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80 - i.e. acceleration values of 35, 50 and 65 respectively. If ***Min Accel'n*** % is set at 100%, then acceleration will not vary as the speed setting is changed.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.5.16 Min Decel'n % ?

Adjusts the minimum value for forward and reverse deceleration (or braking) of the wheelchair. It is programmed in increments of 1% of the ***Deceleration value***. This percentage of the ***Deceleration*** value occurs when the Joystick Module's speed setting is at 1. For example: if ***Deceleration*** is set at 80 and ***Min Decel'n*** % is set at 25% then when the speed setting is 1, deceleration will be 25% x 80 = 20; and when the speed setting is 5, deceleration will be 80. Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80 - i.e. deceleration values of 35, 50 and 65 respectively. If ***Min Decel'n*** % is set at 100%, then deceleration will not vary as the speed setting is changed.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.5.17 Min Turn Acc.% ?

Adjusts the minimum value for turn acceleration of the wheelchair. It is programmed in increments of 1% of the ***Turn Accel'n*** value. This percentage of ***Turn Accel'n*** value occurs when the Joystick Module's speed setting is at 1. For example: if ***Turn Accel'n*** is set at 80 and ***Min Turn Acc.***% is set at 25% then when the speed setting is 1, acceleration will be 25% x 80 = 20; and when the speed setting is 5, the acceleration will be 80. Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80 - i.e. turn acceleration values of 35, 50 and 65 respectively. If ***Min Turn Acc.***% is set at 100%, then acceleration will not vary as the speed setting is changed.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.5.18 Min Turn Dec.% ?

Adjusts the minimum value for turn deceleration (or braking) of the wheelchair. It is programmed in increments of 1% of the ***Turn Decel'n*** value. This percentage of ***Turn Decel'n*** value occurs when the Joystick Module's speed setting is at 1. For example: if ***Turn Decel'n*** is set at 80 and ***Min Turn Dec.***% is set at 25% then when the speed setting is 1, acceleration will be 25% x 80 = 20; and when the speed setting is 5, the acceleration will be 80. Speed settings 2, 3 and 4 will interpolate linearly between 20 and 80 - i.e. turn deceleration values of 35, 50 and 65 respectively. If ***Min Turn Dec.***% is set at 100%, then acceleration will not vary as the speed setting is changed.

Some Power Modules may be factory programmed to limit the value of this parameter. If you want to set the value outside these limits, contact Penny & Giles.

8.2.5.19 Clear Timer ?

This allows you to reset the timer to 0 hours.

8.2.5.20 Erase Fault Log?

This allows you to clear the fault log after a successful repair.

8.2.5.21 Preset Eng Values ?

Selecting this sets all ENGINEER menu parameters to their default values.

8.2.5.22 Back to root ?

This takes you back to the ROOT menu.

Penny & Giles Drives Technology
Division of Autronics Corporation
1580 South Sinclair Street
Anaheim
CA 92806-5933, U.S.A.

Tel: (714) 712 7911
Fax: (714) 978 9512

Penny & Giles Drives Technology
1 Airspeed Road
Christchurch
Dorset
BH23 4HD, U.K.

Tel: (01425) 271444
Fax: (01425) 272655

Fault key

8.3. Fault finding

This paragraph contains hints to faultfinding on the wheelchair. There are also two paragraphs (paragraph 4.3 and 4.4) in the wheelchair manual that might be helpful.

Use a programmer unit to read Pilot+ fault log.

Fault key

Symptoms	Causes	Control method and/or solution
The wheelchair can't drive and a number of fields on the battery indicator flashes.	Fault in the electrical system.	Control method: Use the faultfinding guide from P&G or use a programmer unit to read Pilot+ fault log.
The chair is not driving strait.	Unlike tire pressures.	Check the tire pressures and adjust if necessary
	The castor wheels are wrongly adjusted or the locking ability doesn't work properly.	Block up the castor wheels from the floor and check in accordions with paragraph 6.1.5.
	Defect engine.	Control method: The chair is turning to one side when attempting to drive strait and to the other side when braking. Maybe try to exchange the two wires from engines in power module with one and another. If the chair is now turning to the opposite side the engine is proven defect.
	* Wrong parameter setting. * One engine is more worn than the other one.	The parameter "Steer Correct" has to be adjusted. Try with different settings (see paragraph 8.2).
The wheelchair is weak.	Overheating of power module.	Avoid situations with risk of overheating of the power module. E.g. driving in a hilly or soft terrain for a long time.
	Fault in battery.	* If possible check the battery with a battery tester. * With a voltmeter check that the difference between the measured voltages on the two batteries don't exceed 1.0 V. If the difference is bigger, both batteries should be exchanged with new ones. On new batteries the difference in voltage between the batteries must not exceed 0.04 V.
	Parameter setting.	The parameter "Current Limit" is set to low. (See the standard settings in paragraph 8.5).
	Battery connections.	Poor contact between terminals and wires. Clean and grease with acid free Vaseline.

The chair doesn't drive with maximum speed.	Maximum speed adjusted to low.	Seat lift positioned to high.
	Seat lift positioned to high.	Lower the seat lift till under the switch.
	Defect switch or disrupted electrical circuit for low speed.	Control method: Check the electrical circuit by short-circuits the outputs for reduced speed "GY to BK" at the actuator light module (ALM) (see the electrical diagram in paragraph 8.6). If the chair is now driving in full speed there is a fault somewhere in the circuit.
	Low tire pressures.	Pump air into the tires.
	Low battery voltage.	* Charge the batteries. * A battery is defect.

It is possible to turn ON the chair, but it will not drive, or it stops when driving.	Seat lift is raised above the switch to reduce speed and at the same time the 22 kΩ resistant over "GY to BK" on the ALM is disconnected (see the electrical diagram in paragraph 8.6).	Check the resistant and exchange it if necessary.
	The electrical connection between power module and ALM is disconnected.	Check the connection and re-establish it if necessary.

It is possible to turn ON the chair, but it will not drive and the maximum speed indicator will ripple up and down	The security lock is activated.	Insert the key in charger plug and withdraw it again.

It is possible to turn ON the chair, but it will not drive, or it stops when driving. 9 flashing fields on the battery indicator indicate a fault.	Fault on brake release lever or on the brake cable.	* Micro switch needs to be adjusted. * The lever is in the wrong position. * The brake cable needs to be adjusted (see paragraph 6.1.3).

It is not possible to turn on the chair	Possible faults: * The automatic fuse. * Wires and plugs. * The control box. * The power module. * The batteries.	Control method: 1. Check that the automatic fuse is pushed in. 2. Check that there are approximately 24 V over charger positive and charger negative on the charger socket (see data sheet for control box in paragraph 8.4). 3. Check the wire and the plugs between control box and power module. 4. Check that the battery plug on power module is properly connected and measure the voltage on the two terminals on the plug. 5. If voltage is all right: Try to exchange first the control box and if it doesn't help then the power module. 6. If voltage is not all right: Check batteries and battery circuit.

The chair have a to short driving distance.	Low tire pressure.	Pump air into the tires.
	Battery is defect.	* If possible check battery with a battery tester. * With a voltmeter check that the difference between the measured voltage on the two batteries do not exceed 1.0 V. If the difference exceed 1.0 V, both batteries should be exchanged with new ones. The difference in voltage on the new batteries must not exceed 0.04 V.
	Charger is defect, or a wrong procedure is used when charging.	* Check if batteries are showing any sign that they have been over charged. Normally it is possible to detect that an over charging have occurred, if there can be measured an enlarged voltage on the batteries. A severely over charging can result in a swollen battery case, especially if batteries have also experienced over heating. Check charger (GI Teamtec GBC02) by using test method described in paragraph 5 under charger. * By asking the user of the wheelchair secure that batteries are being charged for a sufficient time and that they are never deeply discharged. (See paragraph 9.1. and 9.2. for further advises about batteries).

Defect in the light system.	Defect bulb, circuit or ALM.	* Check bulbs * To locate the fault, use a voltmeter to measure if there is a voltage on different locations in the circuits.

Defect servo function.	Defect servo function or ALM.	Control method: * To locate the fault, use a voltmeter to measure if there is a voltage on different locations in the circuits. * If one of the servo functions don't work. Check the electrical connections and plugs between actuator and ALM. If they are all right try to connect one of the other servo functions to the output for the function in question on ALM. If this servo function also don't work the ALM is defect and has to be exchanged. If the connected servo function works, the servo function in question is defect and has to be exchanged.

290-mm seat lift will not move down.	There is an electrical connection to chassis.	Control method: Carry out an isolation test between battery and chassis by measuring the voltage between chassis and battery terminal positive and negative. If a voltage is measured locate the fault by systematically disconnecting the different plug connections from the current supply while still measuring the voltage. When the defect circuit is disconnected the voltage between chassis and battery terminal will cease. See the electrical diagram in paragraph 8.6.

The chair will brake to a side when driving on a ramp.	Cable to brake is adjusted too tight.	Check the play in brake lever and adjust brake cable if necessary (see paragraph 6.1.3).
	Defect engine.	Control method: Check if it is the engine there has a defect by exchanging the two wires from engines in power module with one and another. If the chair is now turning to the opposite side the engine is proven defect.

Fault finding

8.3.1.0 Introduction

The primary objective of this chapter is to assist service personnel in finding the likely area of a detected fault within the whole wheelchair electrical system. It is important to realise that even though the controller is signalling a fault, it may not be the controller that is defective. This is because the controller is able to detect faults in other electrical components (motors, batteries, brake etc.) or, more importantly, the wiring to them. Using this guide it is possible to define a fault as belonging to one of 10 types. Once the fault type has been established, there are suggestions as to what may be the possible cause.

This chapter should only be used to decide the starting point of your own diagnosis, as it is possible for the controller to indicate a fault in another component even though the controller itself is at fault. Nevertheless, experience has shown that connectors and wiring are the major cause of wheelchair electrical problems, so it is necessary to examine these most vulnerable areas first.

Most types of PG8 are fitted with a 10 bar battery level indicator, known as the TruCharge display, which also doubles as a comprehensive diagnostic aid. If your controller does not have a TruCharge display then you will need to use a Penny & Giles programmer (DP1 or DP2) in order to read the diagnostic codes listed in this guide.

8.3.2.0 Detecting A Fault Has Occurred

Detection of a fault is usually signified by a **rapid** flashing of the TruCharge display.

Care should be taken because the controllers will give a low battery warning by generating a **slow** flash of this indicator. This is not a fault, just a reminder that you should charge the batteries.

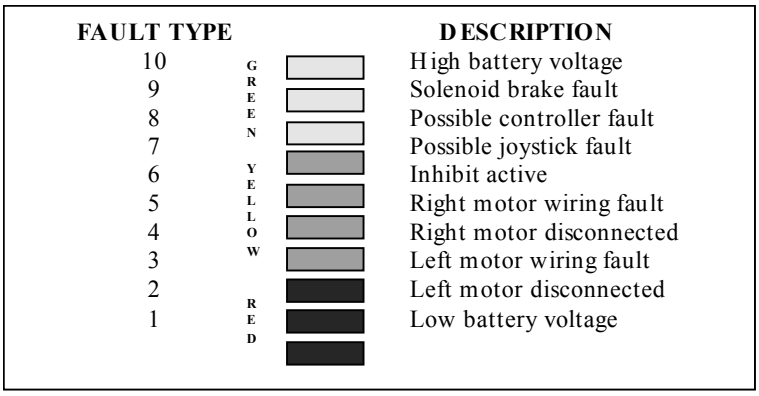
8.3.2.1 Using TruCharge Display as a Diagnostic Aid

The diagram below shows you how to read the TruCharge display in the event of a fault.

If you look at the diagram you will see that 10 different types of fault are defined. The number of bars flashing on TruCharge display indicates the fault type. A brief description for each fault type is also included on the diagram. These fault types and their possible sources are described in more detail in Section 3.

As an example, assume that the wires to the solenoid brake have been disconnected. The controller would detect this as a fault, so in this instance cause 9 bars to flash on the display, corresponding to fault type 9.

8.3.2.2 TruCharge Display Diagnostics



8.3.2.3 Fault Finding Without TruCharge Display

If you do not have a controller with a TruCharge display you will need a Penny & Giles programmer to determine the fault type.

There are three types of programmer that you may have - Pacesetter, DP2, or DP1. In all cases you need to plug the programmer into the controller when the lamp is flashing rapidly, and a fault message will then be displayed on the programmer. The format of the message displayed will vary slightly depending on which type of programmer you are using. As an example, assume that the wires to the solenoid brake have been disconnected. The messages for each programmer type would be as below.

Pacesetter: 15 SOL BRK FAULT

DP2: F 1
5
0
0

DP1: Diagnosis...Code 1500: solenoid brake fault - check brakes and connections

Each message is slightly different, but the one common factor to each is the digits **15.** This is known as the **fault code** and when used in conjunction with the fault tables can be used to determine the fault type, 1 to 10. These fault types and their possible sources are described in more detail in Section 3.

The fault code may be a 2 or 4 digit code depending on which type of programmer you are using. However, the important digits are the first two. Once you have established the fault code you can determine the fault type, then you can read the explanation for each fault type and take the suggested action. The table that follows relates each fault code to a specific fault type, which should enable you to swiftly determine the problem area.

3.0 Fault Tables

First Two Fault Code Digits	Fault Type	Description
0	8	Possible controller fault
1	8	Possible controller fault
2	8	Possible controller fault
3	8	Possible controller fault
4	8	Possible controller fault
5	8	Possible controller fault
6	8	Possible controller fault
7	8	Possible controller fault
8	7	Possible joystick fault
9	7	Possible joystick fault
0A	8	Possible controller fault
0B	8	Possible controller fault
0C	8	Possible controller fault
0D	8	Possible controller fault
0E	7	Possible joystick fault
0F	8	Possible controller fault
10	7	Possible joystick fault
11	8	Possible controller fault
12	8	Possible controller fault
13	8	Possible controller fault
14	8	Possible controller fault
15	9	Solenoid brake fault
16	10	High battery voltage
17	8	Possible controller fault
18	8	Possible controller fault
19	8	Possible controller fault
1A	8	Possible controller fault
1B	8	Possible controller fault
1C	8	Possible controller fault
1D	7	Possible joystick fault
1E	6	Inhibit active
1F	8	Possible controller fault
20	8	Possible controller fault
21	8	Possible controller fault
22	7	Possible joystick fault
23	8	Possible controller fault
24	8	Possible controller fault
25	8	Possible controller fault
26	8	Possible controller fault
27	8	Possible controller fault
28	8	Possible controller fault
29	8	Possible controller fault
2A	8	Possible controller fault
2B	8	Possible controller fault
2C	1	Low battery voltage
2D	8	Possible controller fault
2E	8	Possible controller fault
2F	7	Possible joystick fault

First Two Fault Code Digits	Fault Type	Description
30	7	Possible joystick fault
31	8	Possible controller fault
32	8	Possible controller fault
33	8	Possible controller fault
34	8	Possible controller fault
35	8	Possible controller fault
36	8	Possible controller fault
37	8	Possible controller fault
38	8	Possible controller fault
39	8	Possible controller fault
3A	8	Possible controller fault
3B	2	Left motor disconnected
3C	4	Right motor disconnected
3D	3	Left motor wiring fault
3E	5	Right motor wiring fault
3F	8	Possible controller fault
40 or above		Communications fault between programmer and controller

8.3.4.0 Fault Types and Their Possible Causes

8.3.4.1 Low Battery Fault

This occurs when the controller detects that the battery voltage has fallen below 13.5v. Check the condition of the batteries.

8.3.4.2 Left Motor Disconnected

This occurs when the controller detects that the left motor has become disconnected. Check the left motor, motor connectors and wiring.

8.3.4.3 Left Motor Wiring Fault

This occurs when the controller detects a fault in the wiring to the left motor, in particular a motor connection has “short-circuited” to a battery connection. Check the left motor connectors and wiring.

8.3.4.4 Right Motor Disconnected

This occurs when the controller detects that the right motor has become disconnected. Check the right motor, motor connectors and wiring.

8.3.4.5 Right Motor Wiring Fault

This occurs when the controller detects a fault in the wiring to the right motor, in particular a motor connection has “short-circuited” to a battery connection. Check the right motor connectors and wiring.

8.3.4.6 Inhibit Active

This occurs when the controller detects that the inhibit input is connected. The most common use for the inhibit input is for disabling the drive when the charger is connected. Check that battery charger is disconnected from wheelchair.
Please note this 'fault' occurs if you connect a programmer to a **working** controller when it is turned on. This is not actually a fault but incorrect use of the programmer. To program you must connect the programmer before the controller is turned on.

8.3.4.7 Possible Joystick Fault

This occurs when the controller detects a fault in the joystick or the connections to it. The course of action will differ depending on whether you have an integral (joystick in main box) or remote (separate joystick module) system.

Integral - the fault is in the joystick or connections to it. As the joystick is within the main box, then the controller must be assumed defective and repaired by an authorised person.

Remote - the fault is in the joystick or connections to it. The fault could be in the joystick module, or the cable to it which is attached to the controller. If you have a spare working joystick module, connect it and see if it cures the problem, if it does the original joystick module must be assumed defective and repaired by an authorised person. If the fault is still present with the spare joystick module, then the controller must be assumed defective and repaired by an authorised person.

8.3.4.8 Possible Controller Fault

This occurs when the controller detects a fault within itself. The controller must be assumed defective and repaired by an authorised person.

8.3.4.9 Solenoid Brake Fault

This occurs when the controller detects a fault in the solenoid brake or the connections to it. Check these connections and the solenoid brake.

8.3.4.10 High Battery Fault

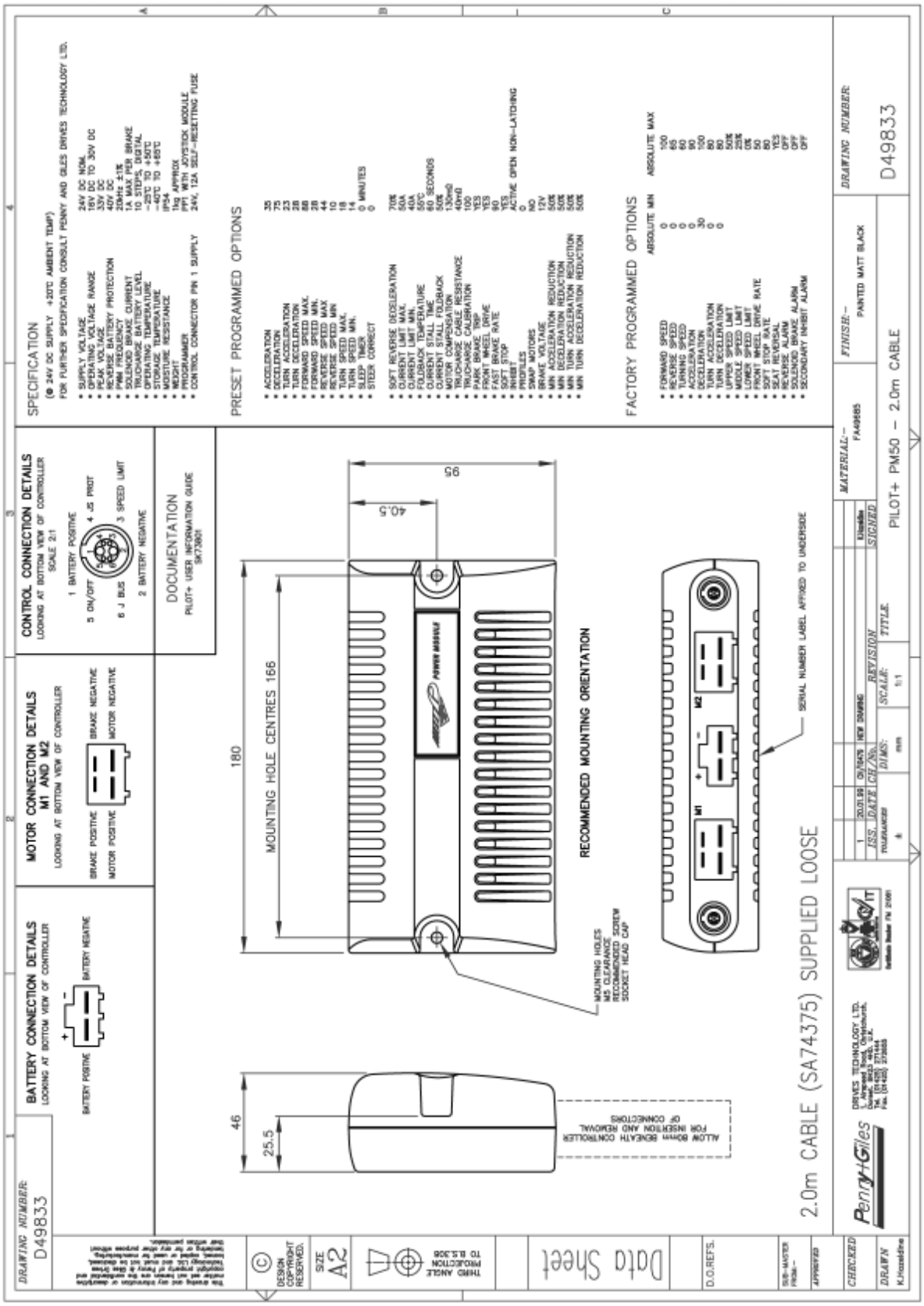
This occurs when the controller detects that the battery voltage has risen above 35v. Check the batteries and the connections to them.

8.3.5.0 Advanced Diagnostics With The DP1b

The special engineering version of the DP1 advanced programmer has the facility to read a fault log which resides inside the PG8 controller. The PG8's fault log keeps a record of the last 8 different fault codes detected by the controller and also keeps a count of the number of occurrences of each of these fault codes, up to a maximum of 31 times. This is a very powerful tool for diagnosing problems, particularly if there is a suspected intermittent problem with the wheelchair electrical system. However, the data needs to be understood and interpreted very carefully before jumping to conclusions. Wheelchair manufacturers who have access to this facility should discuss the implications of the codes displayed in any particular fault log with Penny & Giles before acting on them.

When the DP1 is plugged into the PG8, the ⇓/⇑ keys can be used to locate the **Engineering Menu** which is selected with the **Enter** key. The ⇓/⇑ keys can then be used to find the **Read Fault Log ?** menu, which is again selected with the **Enter** key. The user can then scroll through the fault log with the ⇓/⇑ keys and see up to 8 different fault codes. For example, if the display shows: **1: Code 3B00,** # **5** then the DP1 is displaying the first fault code in the list, which is indicating a left motor connection problem (fault code 3B), and which the controller has detected five times since the fault log was last re-set. To leave the fault log menu select the **Enter** key once more. The fault log can be cleared using the **Erase Fault Log ?** function of the DP1, but it should be recognised that erasing the fault log will destroy any previous fault history held in the controller. Please read Chapter 3, Section 4 for more details on the use of the DP1b.

Data sheets


DRAWING NUMBER: D49833
BATTERY CONNECTION DETAILS
LOOKING AT BOTTOM VIEW OF CONTROLLER
BATTERY POSITIVE
BATTERY NEGATIVE
MOTOR CONNECTION DETAILS M1 AND M2
LOOKING AT BOTTOM VIEW OF CONTROLLER
BRAKE POSITIVE
BRAKE NEGATIVE
MOTOR POSITIVE
MOTOR NEGATIVE
CONTROL CONNECTION DETAILS
LOOKING AT BOTTOM VIEW OF CONTROLLER SCALE 2:1
1 BATTERY POSITIVE
2 BATTERY NEGATIVE
3 SPEED LIMIT
4 JS PROT
5 ON/OFF
6 J BUS
DOCUMENTATION
PILOT+ USER INFORMATION GUIDE SK73801
SPECIFICATION
(@ 24V DC SUPPLY +20°C AMBIENT TEMP)
FOR FURTHER SPECIFICATION CONSULT PENNY AND GILES DRIVES TECHNOLOGY LTD.
SUPPLY VOLTAGE 24V DC NOM.
OPERATING VOLTAGE RANGE 16V DC TO 30V DC
PEAK VOLTAGE 33V DC
REVERSE BATTERY PROTECTION 40V DC
PWM FREQUENCY 20kHz ±1%
SOLENOID BRAKE CURRENT 1A MAX PER BRAKE
TRUCHARGE BATTERY LEVEL 10 STEPS DIGITAL
OPERATING TEMPERATURE -25°C TO +55°C
STORAGE TEMPERATURE -40°C TO +85°C
MOISTURE RESISTANCE IP54
WEIGHT 1kg APPROX
PROGRAMMER PPI WITH JOYSTICK MODULE
CONTROL CONNECTOR PIN 1 SUPPLY 24V, 12A SELF-RESETTING FUSE
PRESET PROGRAMMED OPTIONS
ACCELERATION 35
DECELERATION 73
TURN ACCELERATION 23
TURN DECELERATION 28
FORWARD SPEED MAX. 88
FORWARD SPEED MIN. 28
REVERSE SPEED MAX 44
REVERSE SPEED MIN 18
TURN SPEED MAX. 19
TURN SPEED MIN. 14
SLEEP TIMER 0 MINUTES
STEER CORRECT 0
SOFT REVERSE DECELERATION 70%
CURRENT LIMIT MAX. 60A
CURRENT LIMIT MIN. 60A
FOLDBACK TEMPERATURE 65°C
CURRENT STALL TIME 60 SECONDS
CURRENT STALL FOLDBACK 50%
MOTOR COMPENSATION 130mΩ
TRUCHARGE CABLE RESISTANCE 40mΩ
TRUCHARGE CALIBRATION 100
PARK BRAKE DRIVE YES
FAST BRAKE RATE YES
SOFT STOP 90
INHIBIT ACTIVE OPEN NON-LATCHING
PROFILES 0
SMART MOTORS 150
BRAKE TIMING 1.5S
MIN ACCELERATION REDUCTION 50%
MIN DECELERATION REDUCTION 50%
MIN TURN ACCELERATION REDUCTION 50%
MIN TURN DECELERATION REDUCTION 50%
FACTORY PROGRAMMED OPTIONS
ABSOLUTE MIN ABSOLUTE MAX
FORWARD SPEED 0 100
REVERSE SPEED 0 65
TURNING SPEED 0 80
ACCELERATION 0 90
DECELERATION 0 100
TURN ACCELERATION 30 80
TURN DECELERATION 0 80
UPPER SPEED LIMIT 50%
LOWER SPEED LIMIT 50%
FRONT WHEEL DRIVE RATE 0% 50
SOFT STOP RATE 80
SEAT REVERSAL YES
REVERSE ALARM OFF
SOLENOID BRAKE ALARM OFF
SECONDARY INHIBIT ALARM OFF
MATERIAL:- FA49885
FINISH:- PAINTED MATT BLACK
DRAWING NUMBER: D49833
180
MOUNTING HOLE CENTRES 166
95
40.5
RECOMMENDED MOUNTING ORIENTATION
MOUNTING HOLES M5 CLEARANCE RECOMMENDED SCREW SOCKET HEAD CAP
SERIAL NUMBER LABEL AFFIXED TO UNDERSIDE
M1
M2
46
25.5
ALLOW 80mm BENEATH CONTROLLER FOR INSERTION AND REMOVAL OF CONNECTORS
2.0m CABLE (SA74375) SUPPLIED LOOSE
PILOT+ PM50 - 2.0m CABLE
Penny+Giles
DRIVES TECHNOLOGY LTD.
CHECKED
DRAWN K.Hazeldine
APPROVED
SUB-MASTER No.:-
D.O.REFS.
Data Sheet
THIRD ANGLE PROJECTION BS.308
SIZE A2
© DESIGN COPYRIGHT RESERVED.
TOLERANCES ± mm
SCALE: 1:1
TITLE
REVISION
ISS. DATE CHG No.
1 20.01.99 CN 5425 NEW DRAWING
STIGNED
K.Hazeldine
IT
Griffiths Bexhill TN 21081
DRAWING NUMBER: D49833

DRAWING NUMBER: D49834

BATTERY CONNECTION DETAILS

LOOKING AT BOTTOM VIEW OF CONTROLLER

MOTOR CONNECTION DETAILS M1 AND M2

LOOKING AT BOTTOM VIEW OF CONTROLLER

CONTROL CONNECTION DETAILS

LOOKING AT BOTTOM VIEW OF CONTROLLER
SCALE 2:1

DOCUMENTATION

PILOT+ USER INFORMATION GUIDE
SK73801

SPECIFICATION

(@ 24V DC SUPPLY +20°C AMBIENT TEMP)

FOR FURTHER SPECIFICATION CONSULT PENNY AND GILES DRIVES TECHNOLOGY LTD.

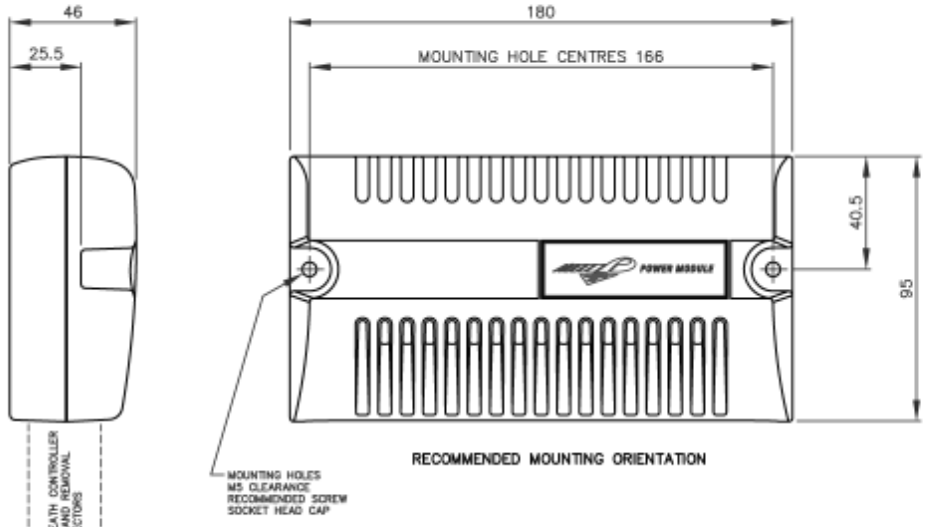
* SUPPLY VOLTAGE	24V DC NOM.
* OPERATING VOLTAGE RANGE	16V DC TO 30V DC
* PEAK VOLTAGE	33V DC
* REVERSE BATTERY PROTECTION	40V DC
* PWM FREQUENCY	20kHz ±1%
* SOLENOID BRAKE CURRENT	1A MAX PER BRAKE
* TRUCHARGE BATTERY LEVEL	10 STEPS, DIGITAL
* OPERATING TEMPERATURE	−25°C TO +50°C
* STORAGE TEMPERATURE	−40°C TO +85°C
* MOISTURE RESISTANCE	IP54
* WEIGHT	1kg APPROX
* PROGRAMMER	PP1 WITH JOYSTICK MODULE
* CONTROL CONNECTOR PIN 1 SUPPLY	24V, 12A SELF−RESETTING FUSE

PRESET PROGRAMMED OPTIONS

* ACCELERATION	35
* DECELERATION	75
* TURN ACCELERATION	23
* TURN DECELERATION	28
* FORWARD SPEED MAX.	85
* FORWARD SPEED MIN.	17
* REVERSE SPEED MAX	40
* REVERSE SPEED MIN	10
* TURN SPEED MAX.	15
* TURN SPEED MIN.	10
* SLEEP TIMER	0 MINUTES
* STEER CORRECT	0
* SOFT REVERSE DECELERATION	90%
* CURRENT LIMIT MAX.	70A
* CURRENT LIMIT MIN.	60A
* FOLDBACK TEMPERATURE	55°C
* CURRENT STALL TIME	60 SECONDS
* CURRENT STALL FOLDBACK	50%
* MOTOR COMPENSATION	100mΩ
* TRUCHARGE CABLE RESISTANCE	40mΩ
* TRUCHARGE CALIBRATION	100
* PARK BRAKE TRIP	YES
* FRONT WHEEL DRIVE	YES
* FAST BRAKE RATE	90
* SOFT STOP	YES
* INHIBIT	ACTIVE OPEN NON−LATCHING
* PROFILES	0
* SWAP MOTORS	NO
* BRAKE VOLTAGE	24V
* MIN ACCELERATION REDUCTION	50%
* MIN DECELERATION REDUCTION	50%
* MIN TURN ACCELERATION REDUCTION	50%
* MIN TURN DECELERATION REDUCTION	50%

FACTORY PROGRAMMED OPTIONS

	ABSOLUTE MIN	ABSOLUTE MAX
* FORWARD SPEED	0	100
* REVERSE SPEED	0	50
* TURNING SPEED	0	40
* ACCELERATION	0	65
* DECELERATION	30	100
* TURN ACCELERATION	0	65
* TURN DECELERATION	0	65
* UPPER SPEED LIMIT		50%
* MIDDLE SPEED LIMIT		25%
* LOWER SPEED LIMIT		0%
* FRONT WHEEL DRIVE RATE		50
* SOFT STOP RATE		80
* SEAT REVERSAL		YES
* REVERSE ALARM		OFF
* SOLENOID BRAKE ALARM		OFF
* SECONDARY INHIBIT ALARM		OFF



2.0m CABLE (SA74375) SUPPLIED LOOSE

This drawing and any information or description shown are the confidential and copyright property of Penny & Giles Drives Technology Limited and may not be used, loaned, copied or communicated directly or indirectly to a third party or be used for any manufacturing purpose without their written permission.

© DESIGN COPYRIGHT RESERVED.

SIZE A2

THIRD ANGLE PROJECTION TO B.S.308

Data Sheet

D.O.REFS.

SUB−MASTER FROM:−

APPROVED

CHECKED

DRAWN K.Hazeldine

Penny+Giles

DRIVES TECHNOLOGY LTD.
1, Aitspeed Road, Christchurch, Dorset, BH23 4HD, U.K.
Tel. (01425) 271444
Fax. (01425) 272655

Certificate Number FM 21091

ISS.	DATE	CH./No.	REVISION	SIGNED
1	22.01.99	Ch/1048E	NEW DRAWING	Hazeldine

TOLERANCES: ±
DIMS: mm
SCALE: 1:1

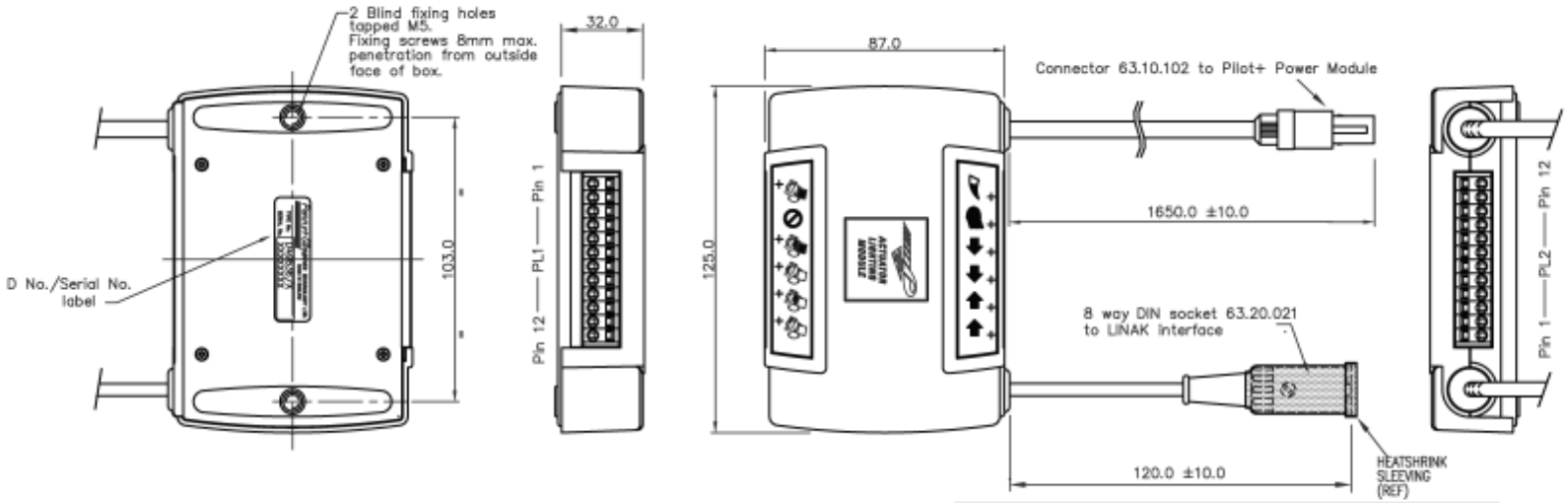
TITLE: PILOT+ PM80 − 2.0m CABLE

MATERIAL:− FA49885

FINISH:− PAINTED MATT BLACK

DRAWING NUMBER: D49834

DRAWING NUMBER: D49836 | Data Sheet | THIRD ANGLE PROJECTION TO B.S.308 | © DESIGN COPYRIGHT RESERVED.


2 Blind fixing holes tapped M5. Fixing screws 8mm max. penetration from outside face of box.
32.0
87.0
Connector 63.10.102 to Pilot+ Power Module
D No./Serial No. label
103.0
Pin 12 —— PL1 —— Pin 1
125.0
1650.0 ±10.0
8 way DIN socket 63.20.021 to LINAK interface
Pin 1 —— PL2 —— Pin 12
120.0 ±10.0
HEATSHRINK SLEEVING (REF)

VIEW FROM FRONT OF DIN SOCKET

LINAK DIN SOCKET

Pin Number	Connection
1	Power supply +12V hand terminal
2	Hand terminal connect signal
3	Hand term. I/P signal Bit 2
4	Power supply 0V hand terminal
5	LED O/P control hand terminal
6	Hand term. I/P signal Bit 0
7	Hand term. I/P signal Bit 3
8	Power supply 0V hand terminal
CASE	Hand term. I/P signal Bit 1

Features
1. Automatic actuator end stop detection – removes drive when end stop is reached.
2. Indicator bulb failure detection – remaining bulb flashes at twice normal rate.
3. Constant bulb brightness maintained over operating voltage range.
4. StVZO compliant.
5. TUV approved.
6. Complies with EMC standards.

Specifications

Operating voltage	Actuators 19 to 30 volts D.C. Lights 15 to 30 volts D.C.
Operating Temperature	–25°C to +50°C ambient
Storage Temperature	–40°C to +65°C
Standby current	<10mA at 24 volts
Lighting outputs	2A maximum at 13.5 volts equivalent
Actuator outputs	NOT GREATER THAN 10 amps, continuous at 24 volts

Connection Details

PL1 Pin Number	PL1 Connection	PL2 Pin Number	PL2 Connection
1	Backrest positive	1	Right indicator positive
2	Backrest negative	2	Right indicator negative
3	–	3	Right indicator positive
4	–	4	Right indicator negative
5	Seat tilt positive	5	Left indicator positive
6	Seat tilt negative	6	Left indicator negative
7	Left footrest positive	7	Left indicator positive
8	Left footrest negative	8	Left indicator negative
9	Seat height positive	9	Front & rear lights positive
10	Seat height negative	10	Front & rear lights negative
11	Right footrest positive	11	Speed limit switch positive
12	Right footrest negative	12	Speed limit switch negative

Notes:
1. Speed limit switch operation depends on configuration of PILOT+ power module.
2. Controller must be turned on and the wheelchair stationary to operate actuators (safety interlock).
3. Both indicator negative connections must be made for each direction to ensure normal operation.

ISS.	DATE	CH/No.	REVISION	SIGNED
1	26.01.99	CH/10482	NEW DRAWING	K.Hazeldine

MATERIAL:– FINISH:–

Penny+Giles DRIVES TECHNOLOGY LTD. 1, Airspeed Road, Christchurch, Dorset, BH23 4HD. U.K. Tel. (01425) 271444 Fax. (01425) 272855 Certificate Number FM 21361

DRAWN	CHECKED	APPROVED
K.Hazeldine		

TOLERANCES: ± 1.0 mm. UNLESS SHOWN | DIMS: mm | SCALE: N.T.S.

TITLE: PILOT+ ALM–5L PLUS LINAK TERMINAL

DRAWING NUMBER: D49836

Standard settings

8.5. Standard setting

The underneath diagram contains the chair setting programmed from the factory. If settings are altered, the new values shall be saved. The wheelchair manual contains a diagram to save the new settings concerning the driving properties.

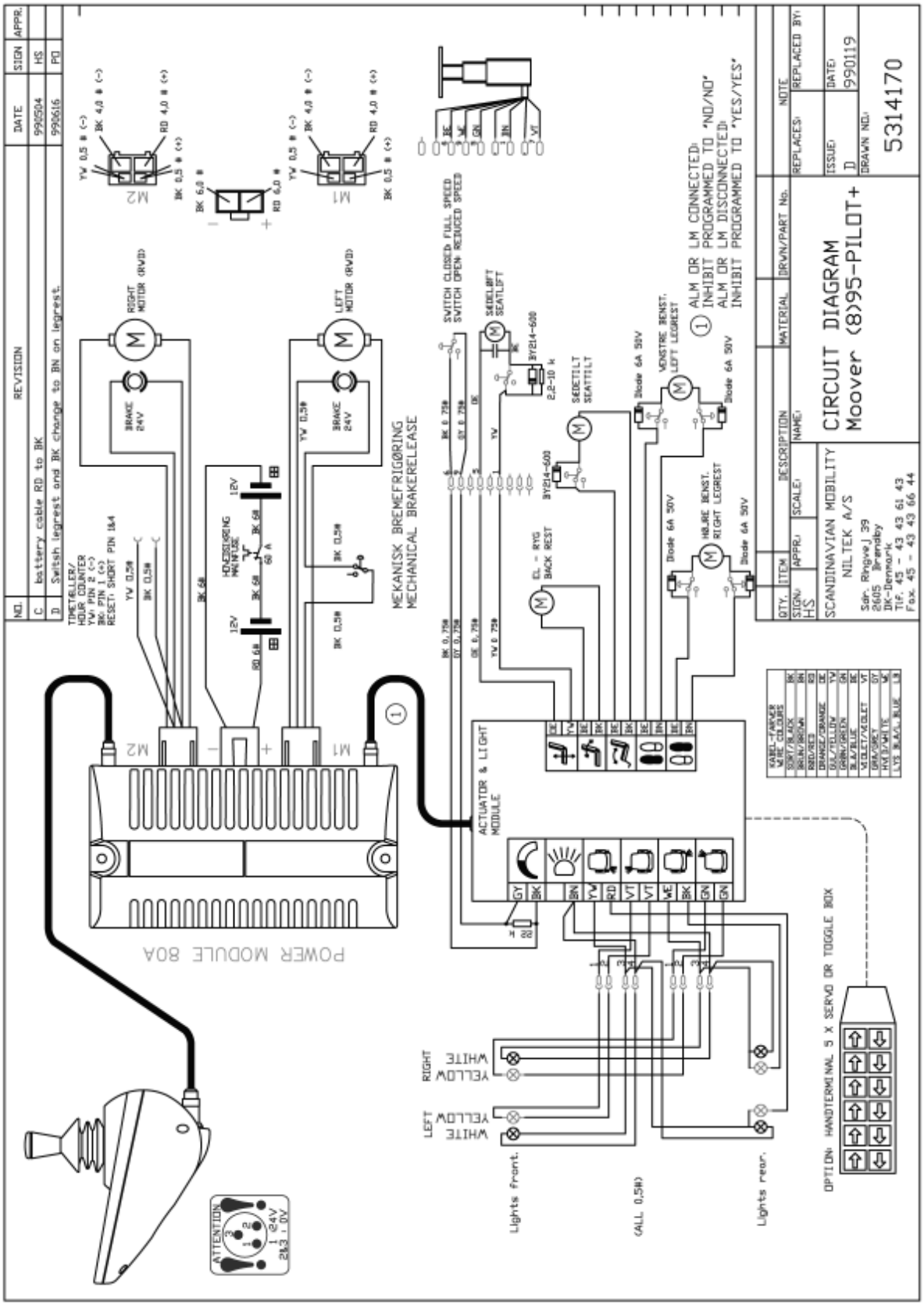
Standard settings for Moover 95 - Flex with PILOT+.

Some parameters have limited values for safety reasons, motors- and battery protection. These are shown as fence values.

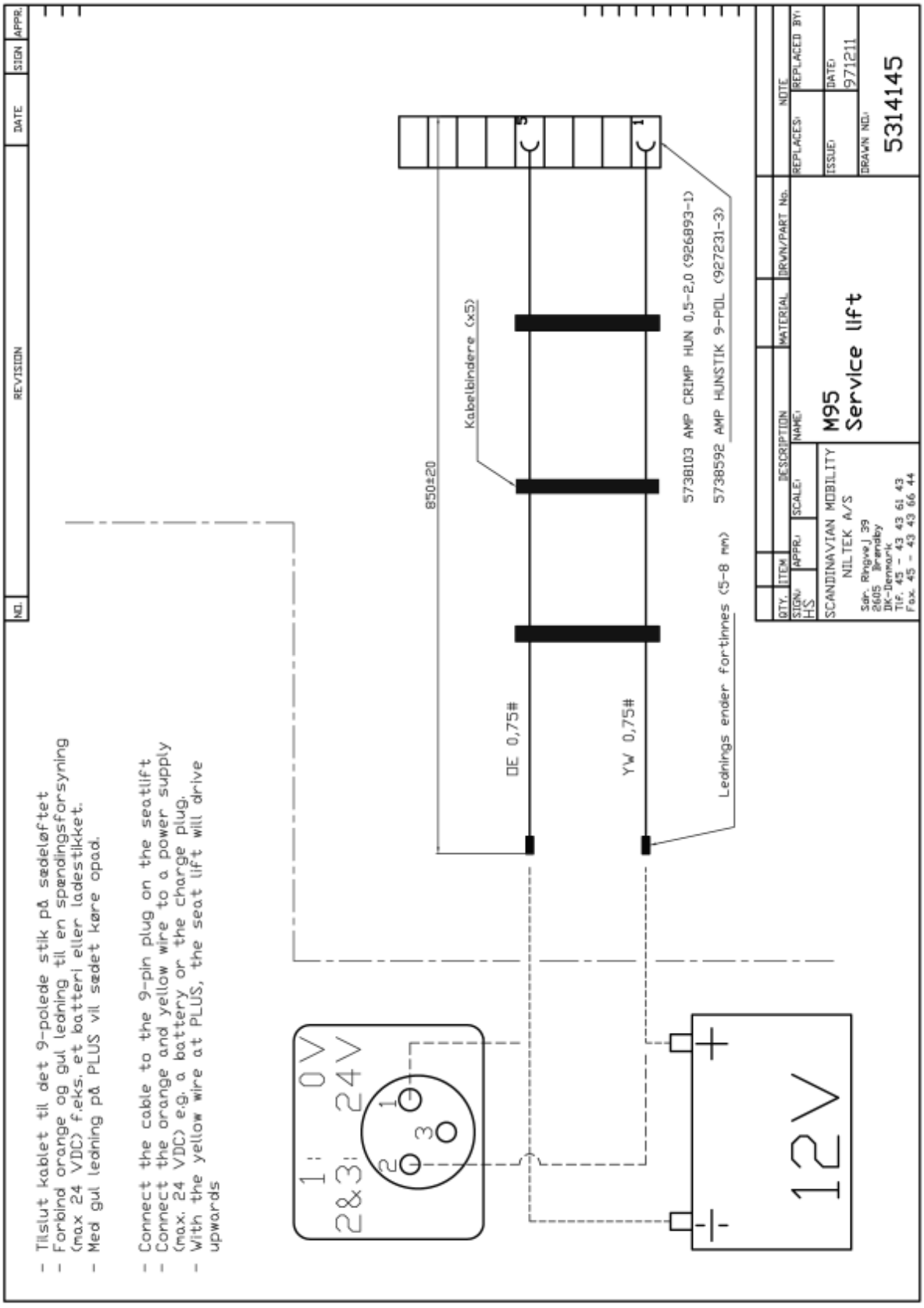
PARAMETER	Moover 90/95 895 RWD	Moover 90/95 985 FWD (*)	Fence values
ACCELERATION	35	35	Max. 65
DECELERATION	80	75	Min. 30
TURN ACCELERATION	32	23	Max. 65
TURN DECELERATION	40	28	Max. 65
FORWARD SPEED	Max. 100 Min. 17	Max.85 Min. 17	-
REVERSE SPEED	Max. 40 Min. 10	Max. 40 Min. 10	Max. 50
TURN SPEED	Max. 21 Min. 10	Max. 15 Min. 10	Max. 40
Sleep Timer	0	0	
Joystick Throw	4 x 100	4 x 100	
Steer Correct	0	0	
Soft Reverse	90	90	
Current Limit	Max. 70 Min. 60	Max. 70 Min. 60	
Foldback Temp.	55 °C	55 °C	
Timed Foldback	60 s / 50%	60 s / 50%	
Compensation	100 mΩ	100 mΩ	
Battery Menu	40 mΩ / 100%	40 mΩ / 100%	
Park Brake Trip	Yes	Yes	
Front Drive	No	Yes	
Fast Brake Rate	90	90	
Soft Stop	Yes	Yes	
Inhibit	No / No	No / No	
Profiles	0	0	
Swap Motors	No	No	
Brake Voltage	24 V	24 V	
Min Accel'n %	50	50	
Min Decel'n %	50	50	
Min Turn Acc. %	50	50	
Min Turn Dec. %	50	50	

(*) FWD settings are standard from P&G.

Eletrical diagram



Data sheets


NO.
REVISION
DATE
SIGN
APPR.
- Tilslut kablet til det 9-polede stik på sædeløftet
- Forbind orange og gul ledning til en spændingsforsyning (max 24 VDC) f.eks. et batteri eller ladestikket.
- Med gul ledning på PLUS vil sædet køre opad.
- Connect the cable to the 9-pin plug on the seatlift
- Connect the orange and yellow wire to a power supply (max. 24 VDC) e.g. a battery or the charge plug.
- With the yellow wire at PLUS, the seat lift will drive upwards
1: 0V
2&3: 24V
12V
850±20
Kabelbindere (x5)
OE 0,75#
YW 0,75#
Lednings ender fortinnes (5-8 mm)
5738103 AMP CRIMP HUN 0,5-2,0 (926893-1)
5738592 AMP HUNSTIK 9-POL (927231-3)
QTY.
ITEM
DESCRIPTION
MATERIAL
DRWN/PART No.
NOTE
SIGN: HS
APPR:
SCALE:
NAME:
M95
Service lift
REPLACES:
REPLACED BY:
ISSUE:
DATE: 971211
DRAWN NO.: 5314145
SCANDINAVIAN MOBILITY
NILTEK A/S
Sdr. Ringvej 39
2605 Brøndby
DK-Denmark
Tlf. 45 - 43 43 61 43
Fax. 45 - 43 43 66 44